A DESCRIPTION OF METHODS REVIEWED

A.1 CA ISO SUMMER 2001 DRP – FIRST RFP BASELINE METHOD TYPE[1]

Data Selection Criteria:
Time Frame Immediately preceding 10 business days.
Exclusions Control days.
Extensions None.

Estimation Method: Interval averages.

Adjustment Methods: None.

A.2 CA ISO SUMMER 2001 DRP – SECOND RFP BASELINE METHOD TYPE[1]

Data Selection Criteria:
Time Frame Top 10 of immediately preceding 11 business days.
Exclusions Control order or request days, days of involuntary service interruptions, single day with lowest event period usage.
Extensions None.

Estimation Method: Interval averages.

Adjustment Methods: None.

A.3 CALIFORNIA MANUFACTURERS AND TECHNOLOGY ASSOCIATION (CMTA) PROPOSED OPTIONAL BINDING MANDATORY CURTAILMENT (OBMC) PLAN[2]

Data Selection Criteria:
Time Frame Immediately preceding 10 business days.
Exclusions Control days.
Extensions None.

Estimation Method: Interval averages.

[1] Second Request for Bids to Provide Demand Relief (Load) for Summer 2001, March 30, 2001, California Independent System Operator Corporation, http://www.caiso.com/docs/2001/03/30/2001033009195918940.pdf.

[2] CMTA's Proposed Program Details For OBMC Pilot Program (R.00-10-002)

Adjustment Methods: Additive adjustment using hours h-1 through h-4.

A.4 NY ISO 2001 DADRP/EDRP BASELINE METHOD[3]

Data Selection Criteria:
Time Frame Top 5 of previous 10 business days, starting n-2.
Exclusions Before counting begins – Immediately preceding day (if weekday).

AFTER ten previous weekdays identified – Exclude Emergency DR program days and days on which a Day-Ahead DR program bid was accepted. Exclude all days not in top five of average event period usage.

AFTER top 5 average usage days chosen – Exclude included day if found to have 4 consecutive hours within the hours of implementation that have usage less than 75% of the average of the top 5 for each of those hours.

Extensions If fewer than 5 days are available after exclusions then eligible days are considered in reverse chronological order starting with day n-12 and with respect to all above exclusions. Only days within 30 days of the event may be considered. If there are not five eligible days in the last 30 days, the baseline load is calculated as an average of those eligible days that do exist.

Estimation Method: Interval averages.

Adjustment Methods: None.

A.5 NY ISO 2002 DADRP/EDRP BASELINE METHOD[4]

Data Selection Criteria:
Time Frame Top 5 of previous 10 business days, starting n-2.
Exclusions Immediately preceding day (if weekday), Emergency DR program days, days on which Day-Ahead DR program bid was accepted and low usage days. Days are added to the 10 day basis incrementally. The first weekday added (n-2, unless otherwise excluded) must have average daily event period usage greater than 25% of peak hourly load of the previous month, otherwise it is excluded as a low usage day. Subsequent days added to the basis must have average daily event period usage e greater than 25% of the average event period usage of the days already included in the basis.

[3] NYISO Day-Ahead Demand Response Program Manual. Revised May 24,2001. New York Independent System Operator

[4] NYISO Day-Ahead Demand Response Program Manual. Revised March 13, 2002. New York Independent System Operator

Exclude all but 5 highest average daily event period usage days.

Extensions Basis should include 10 days unless there are fewer than 10 eligible days in the last thirty days.

Estimation Method: Interval averages.

Adjustment Methods: Optional Scalar adjustment using hours h-3 and h-4. Scalar is bound between .8 and 1.2.

A.6 PJM ECONOMIC LOAD RESPONSE 2002[5]

Data Selection Criteria:
Time Frame Top 5 of previous 10 business days.
Exclusions Immediately preceding day (if weekday), PJM-declared control event day, days on which Day-Ahead DR program bid was accepted.

AFTER ten day basis has been created based on the above exclusions low input days are removed. Day is low input if average daily event usage is less than 75% of ten day event period usage. Low input days are replaced and process repeated.

Exclude all but 5 highest average daily event period usage days.

Extensions Basis should include 10 days unless there are fewer than 10 eligible days in the last thirty days.

Estimation Method: Interval averages.

Adjustment Methods: Optional Temperature-Humidity Index based (THI) scalar adjustment. A simple linear regression is fit with peak hour load as a function of the THI. Using the estimated intercept and slope, load can be estimated with a THI value. The adjustment uses an estimate of load based on the average control day peak hour THI and an estimate of load based on the baseline day peak hour average THI. It is the ratio of the control day estimated load over the baseline day estimated load.

To do the THI adjustment, a minimum of one month of load data from the present season is required. If available a full previous season data set is used.

[5] PJM Economic Load Response Program . Issued March 15th, 2002. Fourth Revise Volume No. 1.

A.7 PJM EMERGENCY LOAD RESPONSE 2001/2002[6]

Data Selection Criteria:
Time Frame Hour before.
Exclusions None.
Extensions None.

Estimation Method: None.

Adjustment Methods: None.

A.8 LBNL/KINNEY BASELINE METHOD TYPE[7]

Data Selection Criteria:
Time Frame Previous ten days.
Exclusions Control days.
Extensions None.

Estimation Method: Explanatory model.
Predictors Average or maximum daily temperature.
Time period Specificity Hourly load data with daily temperature data.
Estimation Criterion OLS.
Full Model Specification

$$L_{dh} = a_h + b_h T_d ,$$

where L_{dh} is hourly load from the ten previous non-controlled business days. T is either average or maximum temperature. a_h and b_h are estimated parameters. Separate regression run for each hour.

Adjustment Methods: None.

A.9 ISO NEW ENGLAND BASELINE METHOD TYPE[8]

Data Selection Criteria:
Time Frame 10 previous business days.
Exclusions Control days are excluded AFTER selection of 10 previous days.

[6] PJM 2001-2002 Load Response Pilot Program.
[7] **DRAFT** Demand Relief and Weather sensitivity in Large California Office Buildings, Kinney, S., Piette, M.A., Gu, L., and Haves, P.

[8] **DRAFT** ISO-NE Load Response Program Manual. 05-07-2002.

Shutdown days are days included in baseline average with 4 consecutive hours for which hourly load is either less than 75% ,or greater than 125%, of the hourly baseline load for each hour.

Extensions If fewer than 7 days for average, days are considered in reverse chronological order until there are 7 eligible weekdays in the simple average.

Estimation Method: Interval averages.

Adjustment Methods: Additive adjustment using hours h-1 and h-2.

A.10 XENERGY WEATHER BASELINE METHOD TYPE

Data Selection Criteria:
Time Frame Minimum of one previous month (flexible).
Exclusions Weekends and holidays, Control days.
Extensions None.

Estimation Method: Explanatory model.
Predictors Heating and cooling degree days.
Time period Specificity Hourly load, cooling degree days based on daily average.
Estimation Criterion OLS, R-squared optimized over cooling degree base choices.
Full Model Specification

$$L_{dh} = \sum_{h=1}^{24} a_h D_h + \sum_{h=1}^{24} b_h D_h CDD_d + \sum_{h=1}^{24} c_h D_h HDD_d$$

where L_{dh} = load, CDD and HDD are cooling and heating degree days, respectively, D = Data time frame, a and b are estimated regression parameters.

Adjustment Methods: Additive adjustment using hours h-1 and h-2.

A.11 NEXANT BASELINE METHOD TYPE

Data Selection Criteria:
Time Frame Immediately preceding 10 business days.
Exclusions Control days.
Extensions None.

Estimation Method: Interval averages.

Adjustment Methods: Scalar adjustment using hour h-1.

A.12 UTILITY A – MATCH DAY

Data Selection Criteria:
Time Frame Previous Month.
Match Criteria Demand based (i.e. high demand days), or weather based (>75 degrees).
Exclusions Weekends and holidays, Control days.
Extensions If insufficient match days are found in previous month, match criteria is made more inclusive (i.e. high and medium demand days or >70 degrees).

Estimation Method: Interval averages.

Adjustment Methods: Scalar adjustment using one hour between 8am and 11am.

A.13 UTILITY B

Data Selection Criteria:
Time Frame Previous five business days.
Exclusions Control days.
Extensions None.

Estimation Method: Interval averages.

Adjustment Methods: None.

A.14 UTILITY C – REGRESSION-BASED

Data Selection Criteria:
Time Frame Flexible.
Exclusions Control days.
Extensions None.

Estimation Method: Multiple explanatory models.
Predictors Weather Parameters.
Time period Specificity Hourly load, hourly weather parameters.
Estimation Criterion Unknown. Model is a structural time series model.
Full Model Specification Actual specification is unknown. The approach has two steps. First, mean hourly load over the event period is estimated with the structural time series model. Second, the Haar transform is used to estimate the load shape within the 8-hour event period conditional on average load.

Adjustment Methods: None.

A.15 UTILITY D

Data Selection Criteria:
Time Frame June through September.
Exclusions Weekends, control days.
Extensions None.

Estimation Method: Explanatory model.
Predictors Lagged dry bulb temperature, 5am to 10am average load.
Time period Specificity Hourly load, hourly lagged dry bulb temperature.
Estimation Criterion OLS.
Full Model Specification

$$L_{dh} = a_h + b_h AMK_d + c_h LgDB_h$$

where L_{dh} is hourly load, June through September, AMK_d is the average load between 5am and 10am for that day, and $LgDB_h$ is a lagged temperature measure. a_h, b_h and c_h are estimated parameters. Separate regressions are estimated for each hour.

Adjustment Methods: None.

A.16 UTILITY E

Data Selection Criteria:
Time Frame Full year.
Match day Criteria Match ten day-pairs to the control day day-pair. Control day day-pair consists of control day hours prior to event and the whole prior day. Ten days with the lowest sum of square errors relative to the control day pair are included in baseline calculation.
Exclusions None.
Extensions None.

Estimation Method: Interval averages.

Adjustment Methods: Control day-pair loads are regressed on their baseline counterparts.

$$L_{dq} = a_q + b_q L_{Dq}$$

where L_{dq} is fifteen-minute interval load during the control day-pair period and L_{Dq} is the average fifteen-minute interval load over the baseline day-pairs. a_q and b_q are estimated parameters. If the regression explains 50% of the variation (R-squared > .5) then the fit values for the control period hours are used as the baseline.

A.17 UTILITY F

Data Selection Criteria:
Time Frame Previous two years.
Match Criteria Certain hot days.
Exclusions Anomalous loads.
Extensions None.

Estimation Method: Interval averages.

Adjustment Methods: Scalar adjustment using hours h-1 and h-2.

B

PERFORMANCE RELATIVE TO CURTAILMENT AMOUNT

Figure B-1
Median Relative Hourly Error
Summer Curtailed Weather-Sensitive Low-Variability Accounts

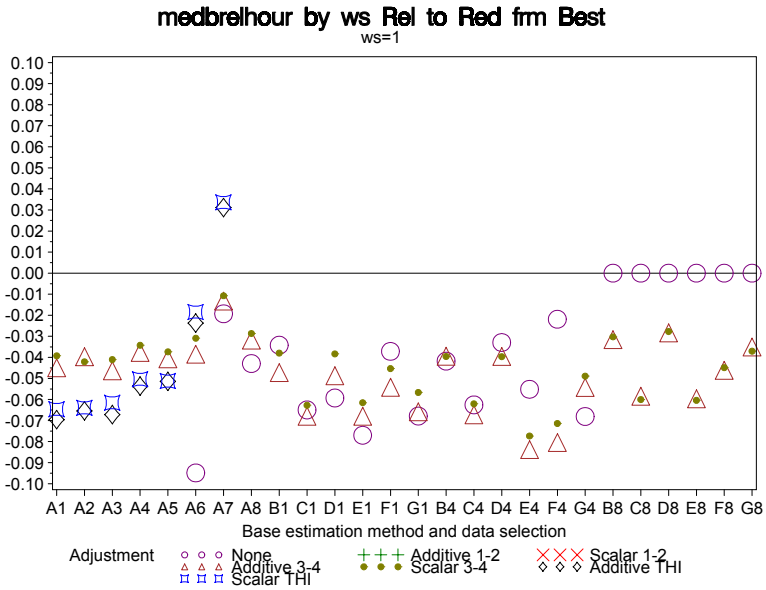


Figure B-2
Median Account Theil's U
Summer Curtailed Weather-Sensitive Low-Variability Accounts

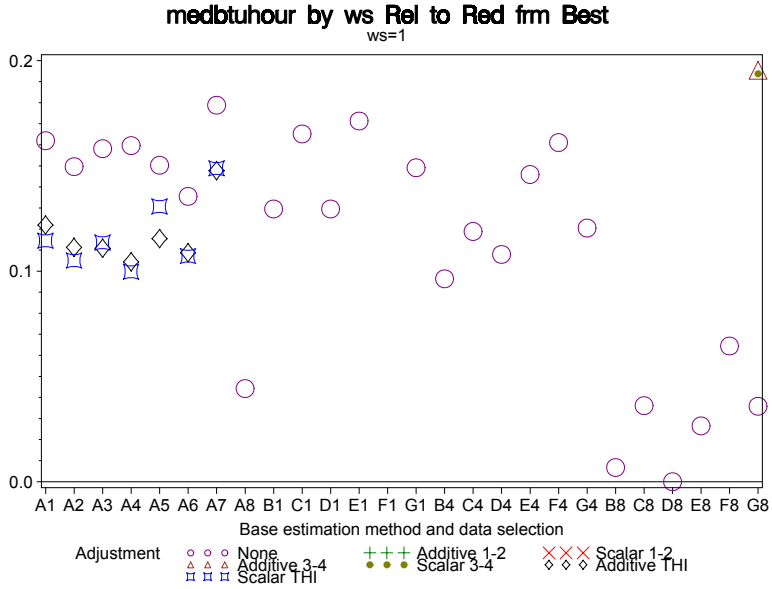


Figure B-3
95th Percentile Account Theil's U
Summer Curtailed Weather-Sensitive Low-Variability Accounts

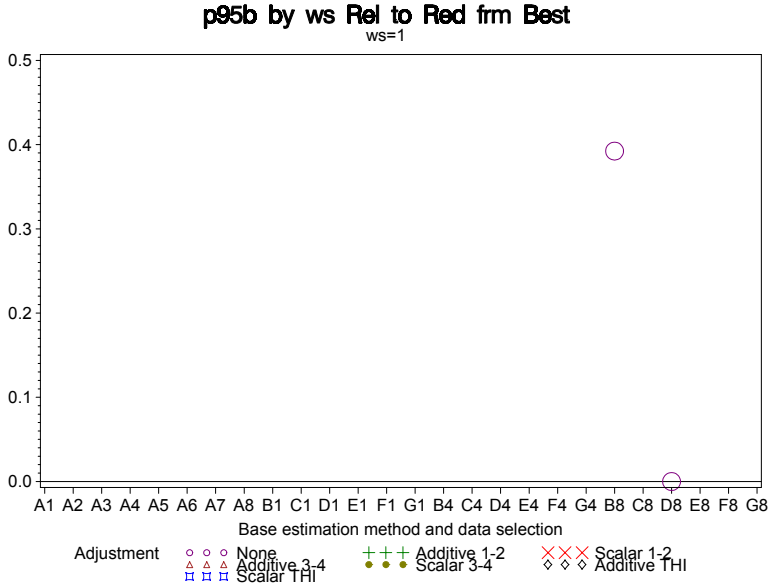


Figure B-4
Median Relative Hourly Error
Summer Curtailed Weather-Sensitive High-Variability Accounts

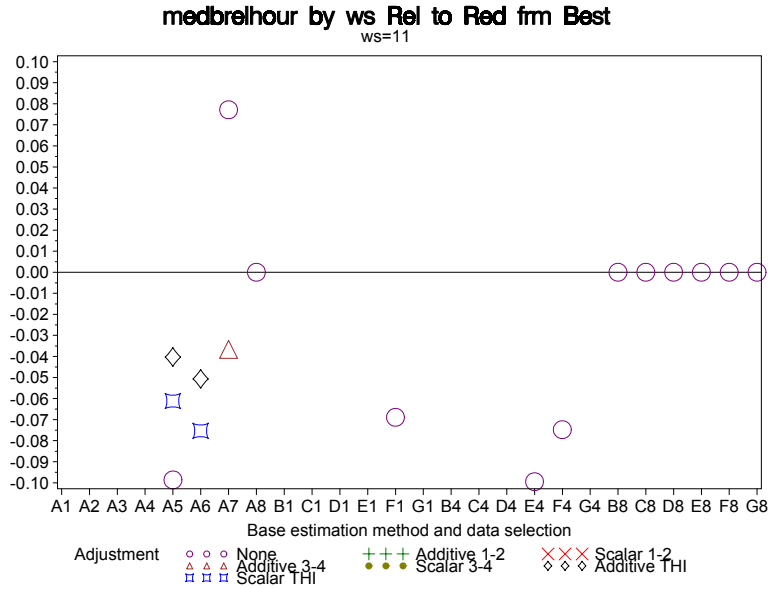


Figure B-5
Median Account Theil's U
Summer Curtailed Weather-Sensitive High-Variability Accounts

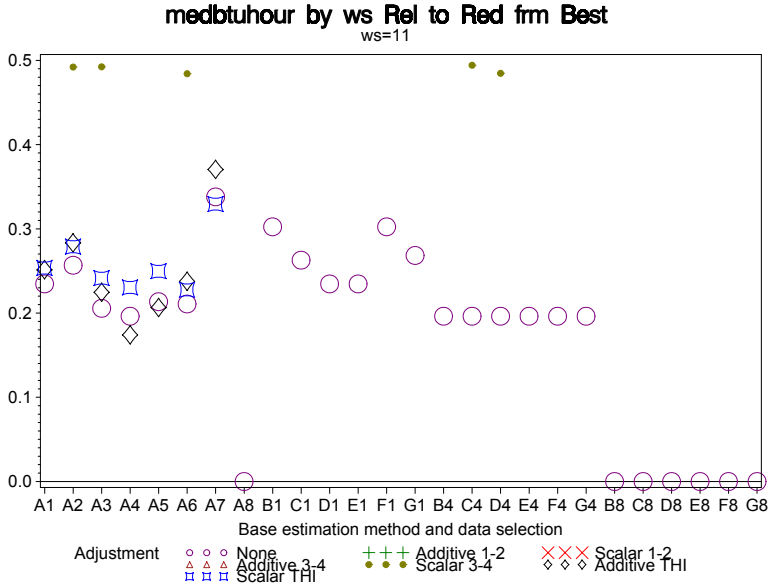


Figure B-6
95th Percentile Account Theil's U
Summer Curtailed Weather-Sensitive High-Variability Accounts

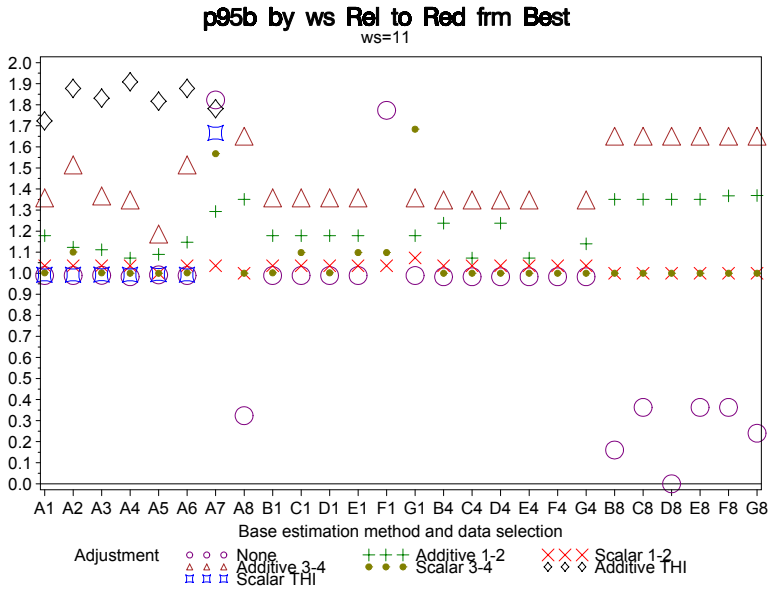


Figure B-7
Median Relative Hourly Error
Summer Curtailed Non-Weather-Sensitive Low-Variability Accounts

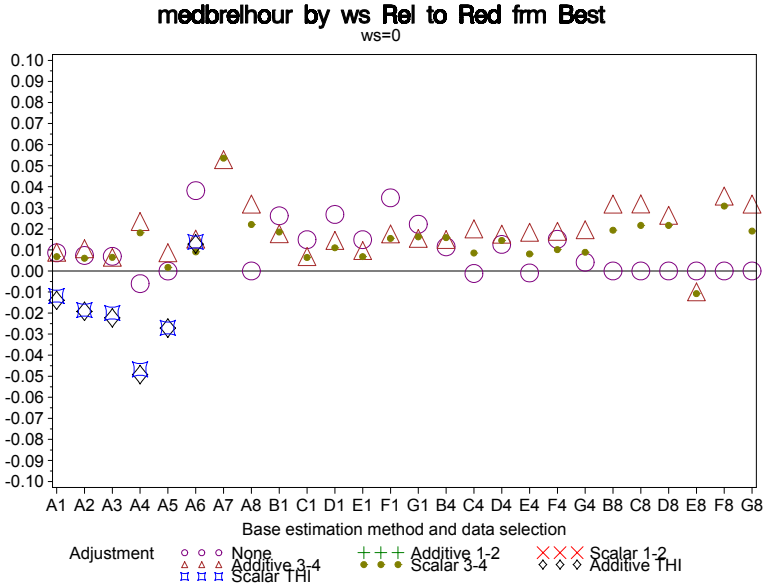


Figure B-8
Median Account Theil's U
Summer Curtailed Non-Weather-Sensitive Low-Variability Accounts

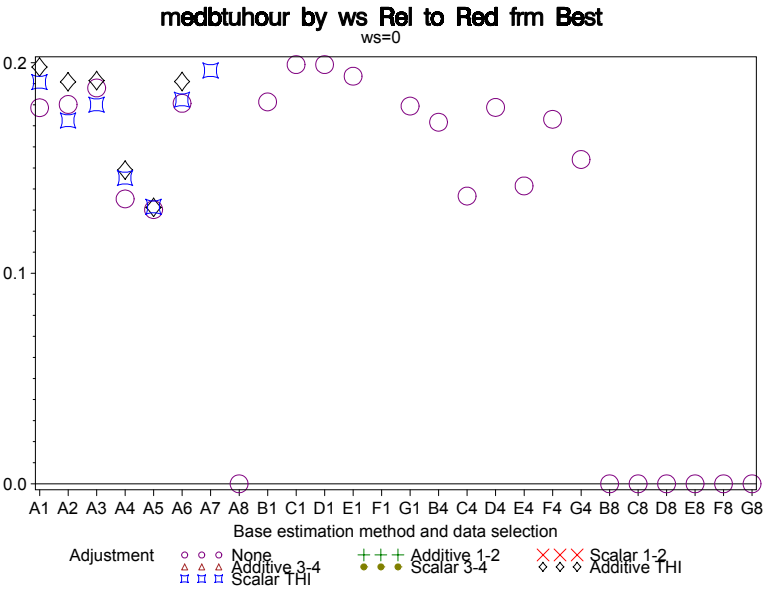


Figure B-9
95th Percentile Account Theil's U
Summer Curtailed Non-Weather-Sensitive Low-Variability Accounts

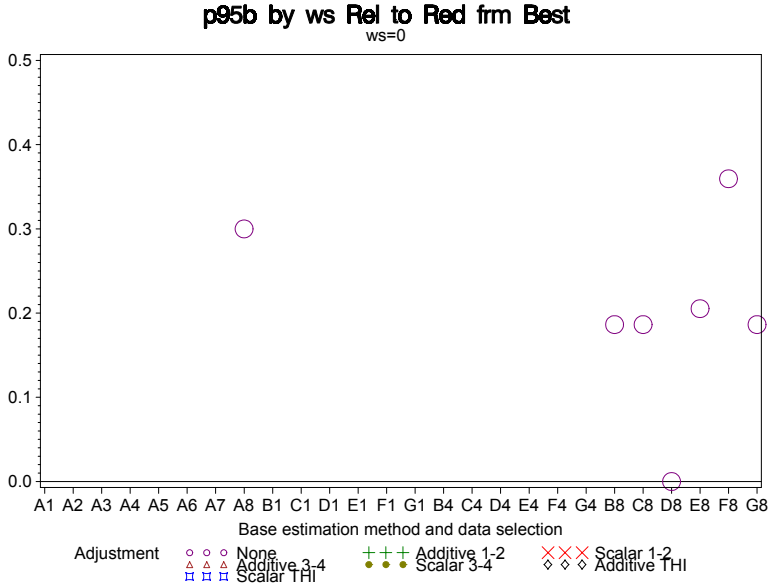


Figure B-10
Median Relative Hourly Error
Summer Curtailed Non-Weather-Sensitive High-Variability Accounts

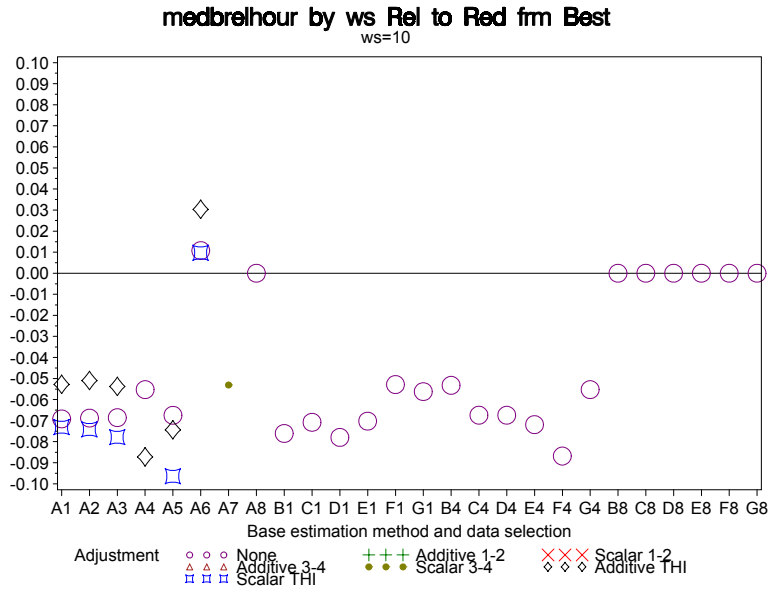


Figure B-11
Median Account Theil's U
Summer Curtailed Non-Weather-Sensitive High-Variability Accounts

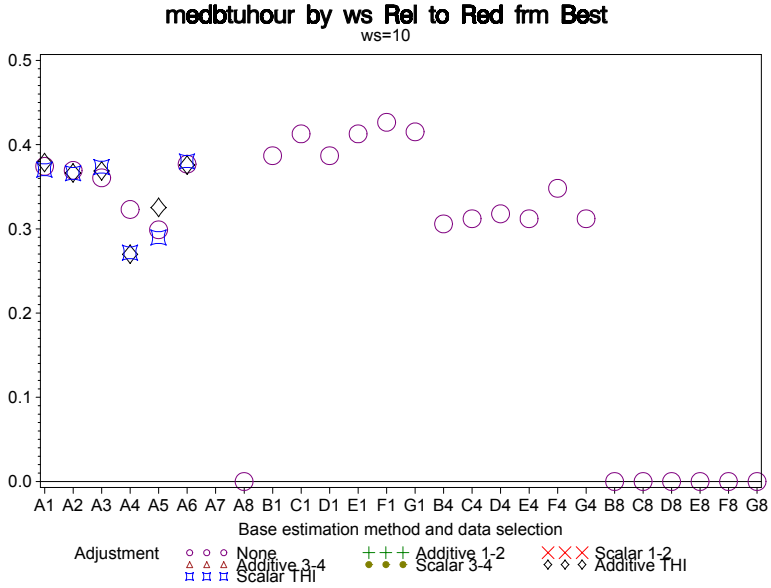


Figure B-12
95th Percentile Account Theil's U
Summer Curtailed Non-Weather-Sensitive High-Variability Accounts

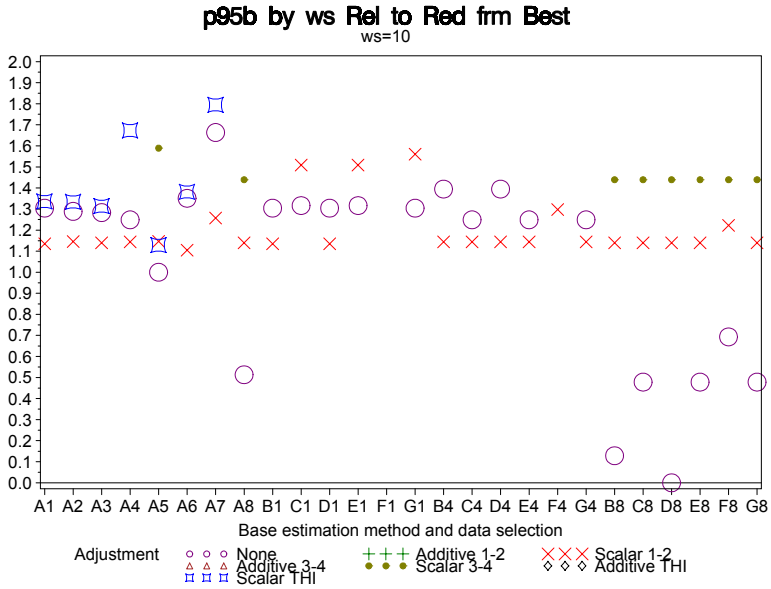


Figure B-13
Median Relative Hourly Error
Nonsummer Curtailed Weather-Sensitive Low-Variability Accounts

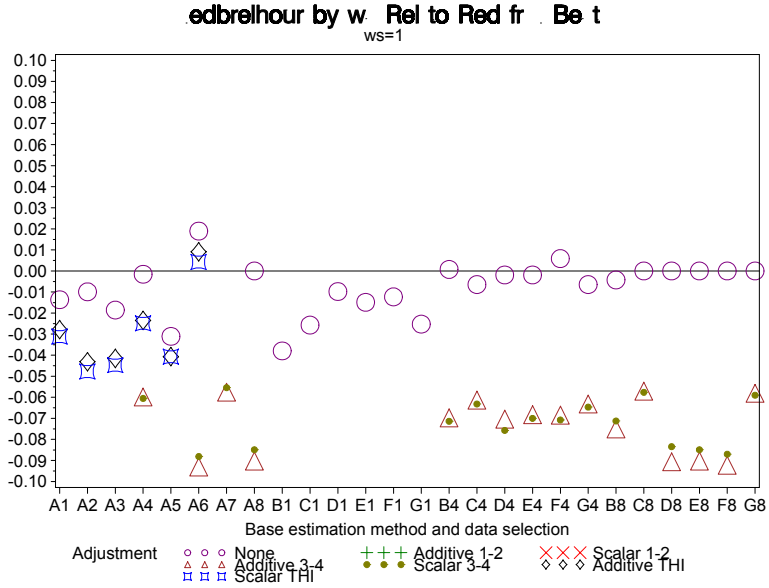


Figure B-14
Median Account Theil's U
Nonsummer Curtailed Weather-Sensitive Low-Variability Accounts

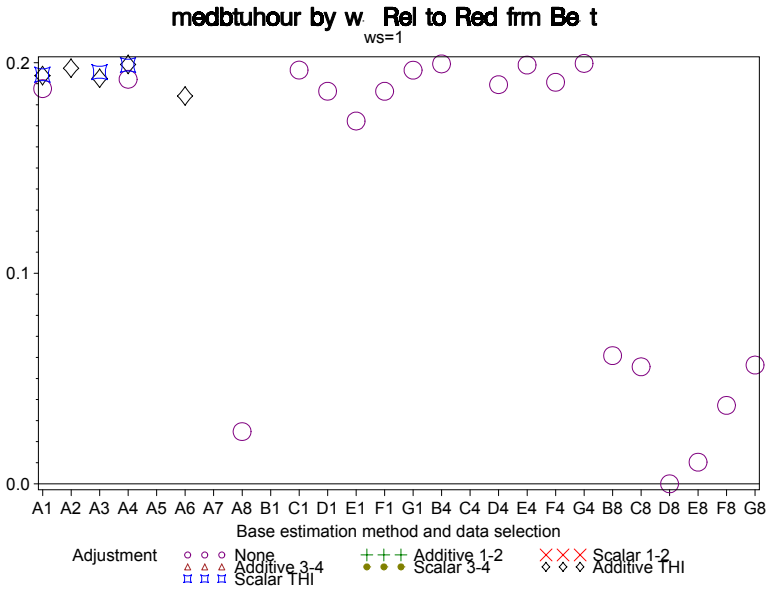


Figure B-15
95th Percentile Account Theil's U
Nonsummer Curtailed Weather-Sensitive Low-Variability Accounts

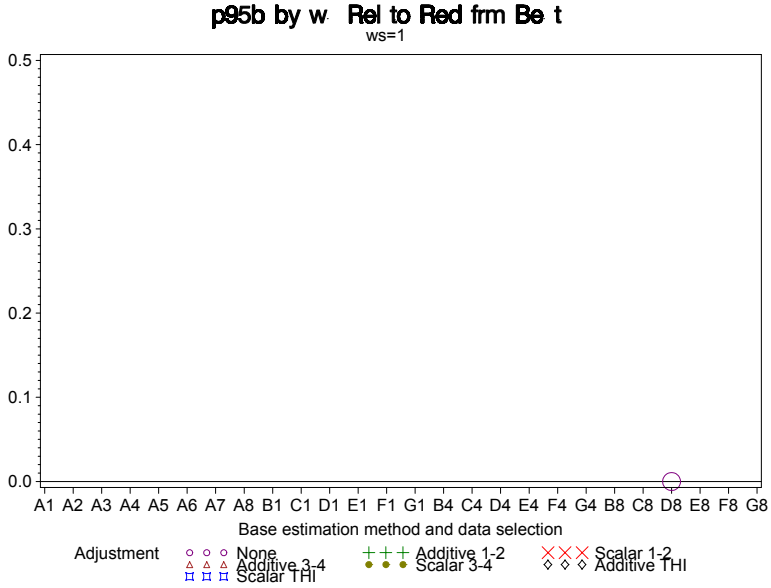


Figure B-16
Median Relative Hourly Error
Nonsummer Curtailed Weather-Sensitive High-Variability Accounts

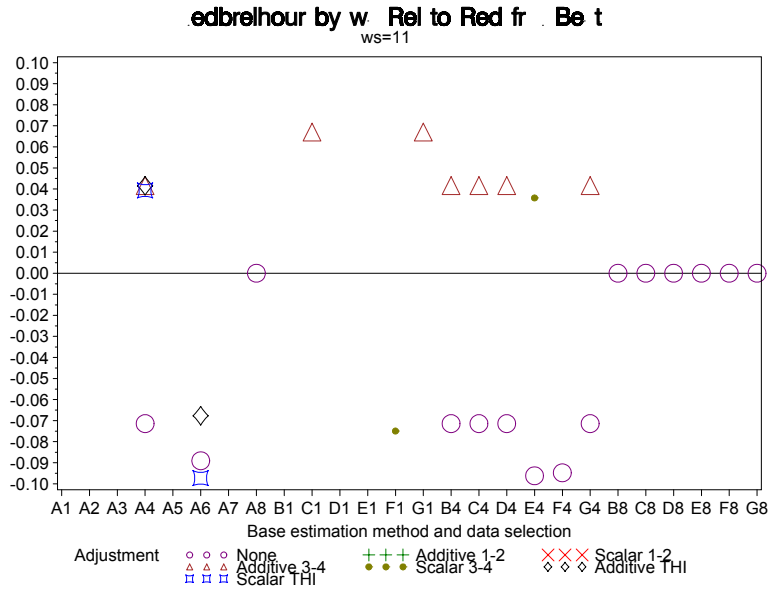


Figure B-17
Median Account Theil's U
Nonsummer Curtailed Weather-Sensitive High-Variability Accounts

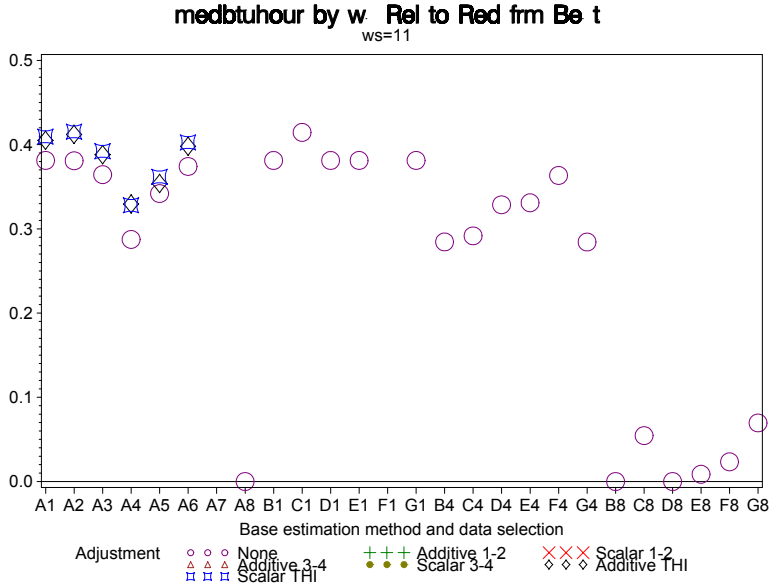


Figure B-18
95th Percentile Account Theil's U
Nonsummer Curtailed Weather-Sensitive High-Variability Accounts

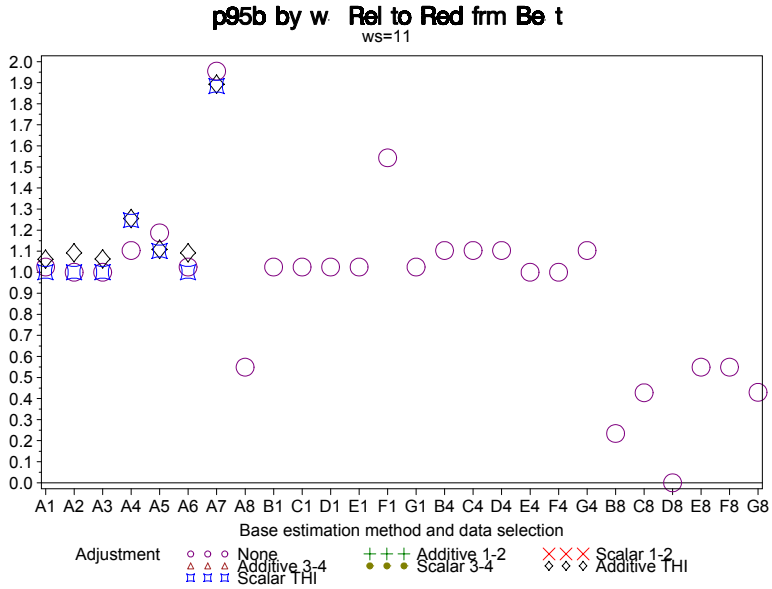


Figure B-19
Median Relative Hourly Error
Nonsummer Curtailed Non-Weather-Sensitive Low-Variability Accounts

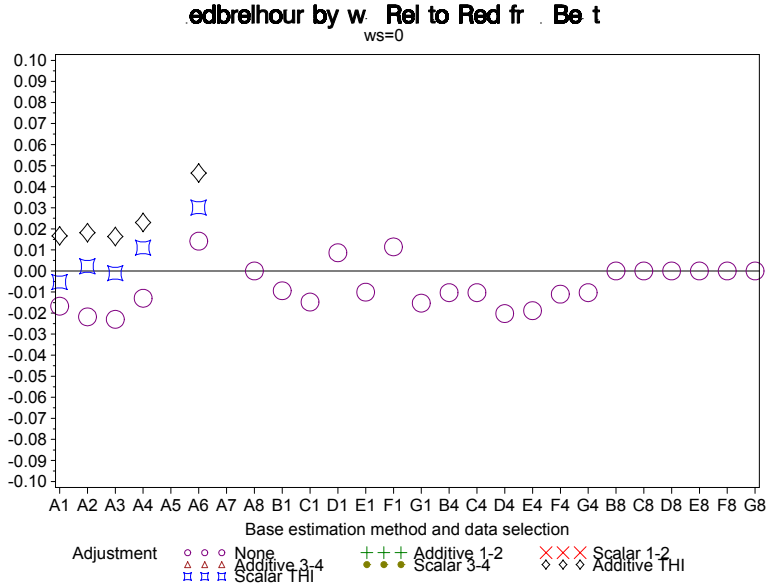


Figure B-20
Median Account Theil's U
Nonsummer Curtailed Non-Weather-Sensitive Low-Variability Accounts

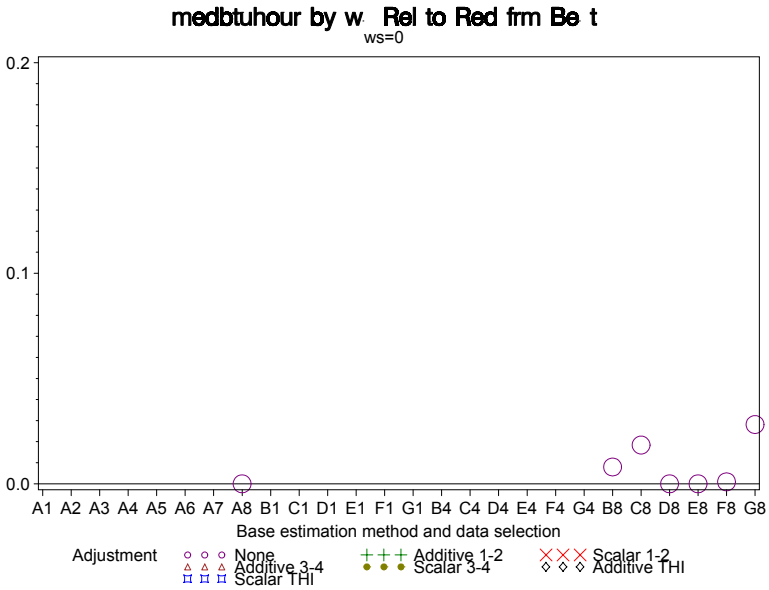


Figure B-21
95th Percentile Account Theil's U
Nonsummer Curtailed Non-Weather-Sensitive Low-Variability Accounts

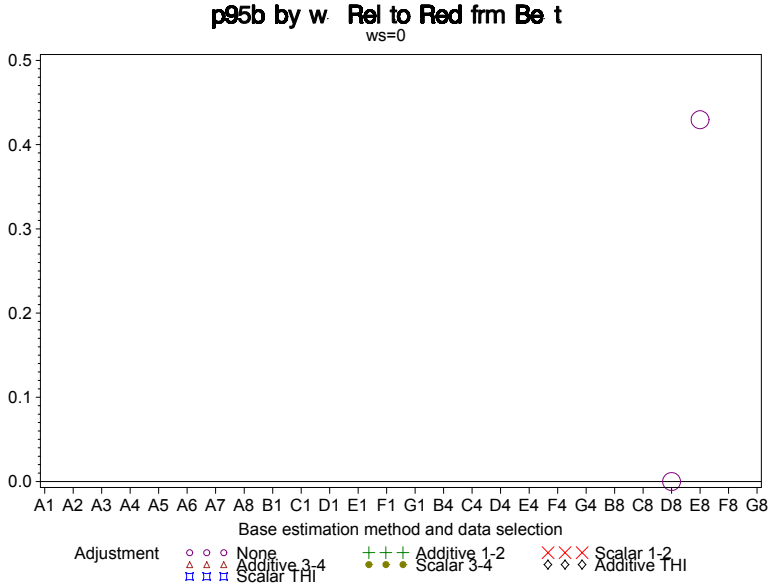


Figure B-22
Median Relative Hourly Error
Nonsummer Curtailed Non-Weather-Sensitive High-Variability Accounts

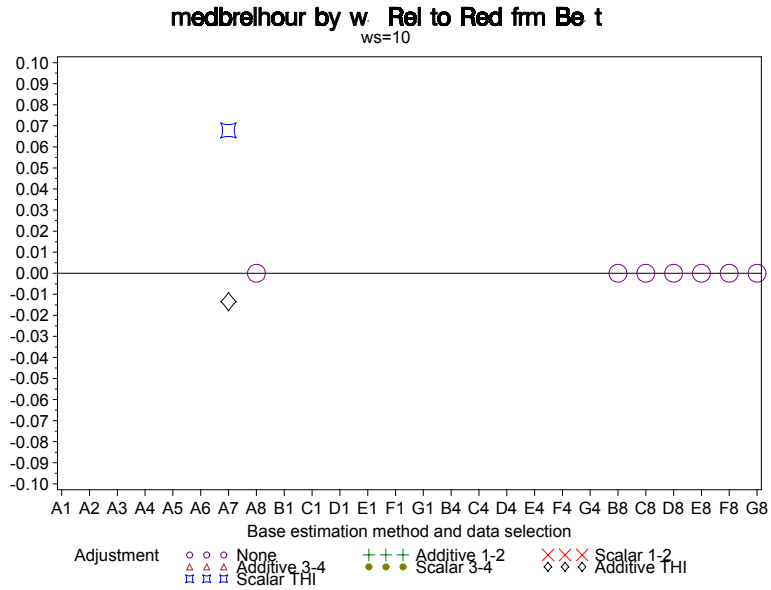


Figure B-23
Median Account Theil's U
Nonsummer Curtailed Non-Weather-Sensitive High-Variability Accounts

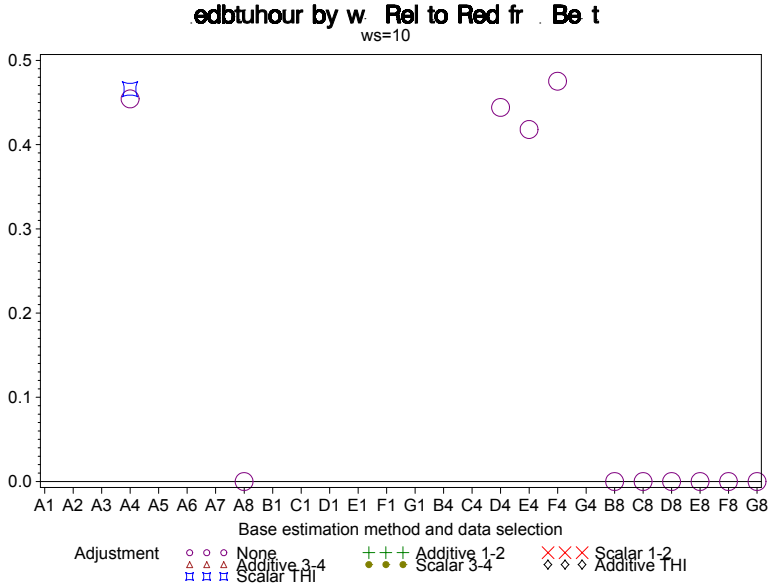
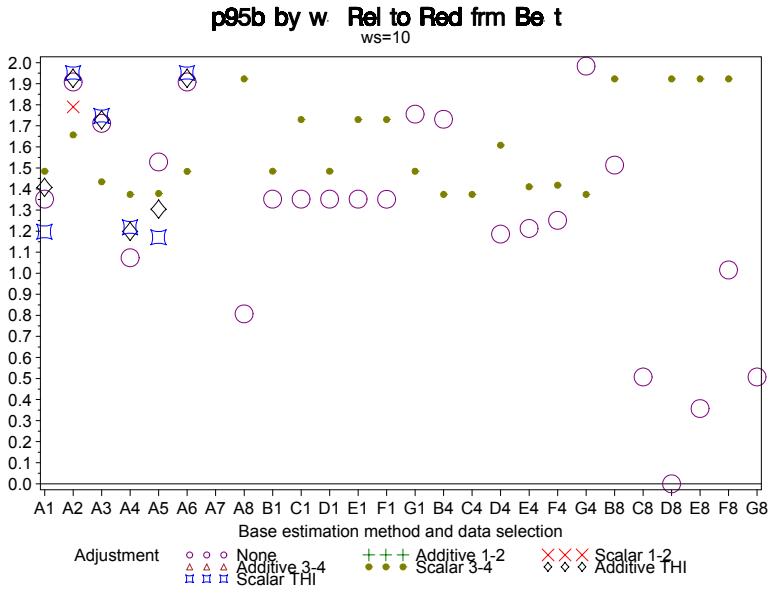


Figure B-24
95th Percentile Account Theil's U
Nonsummer Curtailed Non-Weather-Sensitive High-Variability Accounts



C

GLOSSARY

Additive adjustment: An adjustment method by which a fixed amount is added to the provisional baseline load in each interval.

Adjustment method: An additive or scalar adjustment to a provisional baseline as the final step in a baseline calculation methodology.

Averaging: A baseline estimation method whereby the provisional baseline for each hour (or finer interval) of the day is the simple average, over all days used in the estimation, of the load at that hour.

Baseline Calculation Methodology: A set of procedures for calculating a CBL. In this document, a baseline methodology is defined by an estimation method, a set of data selection criteria, and an adjustment method.

Bias: Systematic tendency of an estimation to over- or under-state the true value. Technically, the expected value of the difference between the estimate and the true value. In this study, the median relative hourly error is used as the measure of bias.

CA ISO: The California ISO.

CBL: Customer baseline.

Control period: Curtailment period.

Curtailed account: In this study, an account that had one or more actual curtailment periods during the time span of the data available for the study.

Curtailment period: A period during which DRP participants would have been required or incented to reduce demand.

Curtailment: Demand response.

Customer Baseline (CBL): In a demand-response program, the load level for a particular customer for each interval of a curtailment period, compared to which demand reduction in each interval is calculated. The customer's demand reduction in each interval is calculated as the difference between the customer's CBL and its metered load.

Data selection criteria: The rules and process for selecting the days and intervals that will be included in calculating the CBL.

Demand Reduction: Demand response.

Demand Response (DR): Reducing demand in response to a curtailment notification or short-term price signal. Also, the magnitude of the reduction, in kW.

Demand Response Program (DRP): A program operated by an electric utility, ISO, energy service company, or retail energy supplier to encourage end-use customers to reduce their peak loads on short notice (under two to 24 hours) in exchange for some form of compensation.

DR: Demand response.

Estimation method: The calculations applied to a set of data to determine the CBL, after the selection of included and excluded data points, and before any adjustment is applied.

Free Ridership: Obtaining incentive payments for load reductions that would have taken place without the program.

Gaming: Altering behavior to manipulate a baseline to the advantage of the customer.

High variability: A characteristic of an account, indicating that the load at a given hour of the day exhibits high variation from one uncontrolled business day to the next.

Independent System Operator: The regional electric grid operator, particularly in markets that have been opened to retail electric competition.

International Performance Measurement and Verification Protocol (IPMVP): A set of documents providing guidance on methods for quantifying the long-term results of energy efficiency projects. Also, the organization responsible for the continued development of the concept of standardized verification methods, distribution of the documents, and providing guidance and training on the appropriate use of the documents.

IOU: Investor-Owned utility.

IPMVP: International Performance Measurement and Verification Protocol.

ISO: Independent System Operator.

ISO-NE: The New England ISO.

Load type: In this report, a classification of an account according to whether or not it is weather-sensitive and whether it has high or low variability.

Low-variability load: A characteristic of an account, indicating that the load at a given hour of the day exhibits low variation from one uncontrolled business day to the next.

M&V: Measurement and verification.

Measurement and Verification (M&V): the procedures used to determine savings in programs where compensation is paid based on the achieved savings.

Nonsummer: The months October through May.

Non-weather-sensitive: A characteristic of an account, indicating that the load variations are not related to weather conditions.

NYISO: The New York ISO.

PJM: The Pennsylvania, New Jersey, Maryland ISO.

Protocol: A set of procedures for calculating savings.

Relative Root-Mean-Square Error: In this study, another term for Theil's U.

Scalar adjustment: An adjustment method by which the provisional baseline load in each interval is multiplied by a constant or scalar.

Simple adjustment: An additive or scalar adjustment, where the additive or scalar is calculated as the difference or ratio of the average provisional baseline to the average actual load for some period prior to the control period. After simple adjustment, the average adjusted baseline matches the average actual load over the hours used to calculate the adjustment amount.

Summer: The months June through September.

Temperature-Humidity Index: An index based on daily temperature and humidity, as an indicator of the intensity of cooling requirements on a given day.

Theil's U: A measure of the typical magnitude of error, relative to the typical actual value, calculated as the ratio of the root-mean-square error to the root-mean-square actual.

THI: Temperature-Humidity Index.

Uncurtailed account: In this study, an account that had no curtailment periods during the time span of the data available for the study.

Weather model: A baseline estimation method using a regression model with weather terms as predictors.

Weather-based adjustment: An additive or scalar adjustment, where the additive or scalar is calculated as the difference or ratio of load estimated using control-period weather conditions to load estimated using weather conditions for period used to calculate the provisional baseline. Both load estimates use the same weather-based load model, fitted to data for a time period prior to either period used to produce the load estimates.

Weather-sensitive: A characteristic of an account, indicating that the load tends to increase or decrease according to weather conditions such as temperature and humidity.